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Original Article

# Prevalence and contributing factors of severe perineal damage following episiotomy-assisted vaginal delivery

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ABSTRACT

*Objective:* This study was conducted to investigate the risk factors of third- and fourth-degree lacerations following vaginal deliveries in Taiwanese women, and to offer clinical guidance for the reduction of severe perineal lacerations.

*Materials and methods:* A total of 1879 women who underwent vaginal deliveries assisted by midline episiotomy at a tertiary hospital were included. Obstetric risk factors were analyzed for women with and without third- and fourth-degree lacerations.

*Results:* Two hundred and five deliveries (10.9%) resulted in third- or fourth-degree lacerations. Parity, duration of first and second stages of labor, rate of instrument-assisted vaginal deliveries, the newborn's birth weight and head circumference, and the ratio of the newborn's birth weight to maternal body mass index were significantly different between women with and without severe perineal lacerations. Logistic regression demonstrated that nulliparity (odds ratio = 3.626, $p < 0.001$), duration of second stage of labor (odds ratio = 1.102, $p = 0.044$), instrument-assisted vaginal delivery (odds ratio = 4.102, $p < 0.001$), and newborn's head circumference (odds ratio = 1.323, $p < 0.001$) were independent risk factors of severe perineal lacerations. Instrument-assisted vaginal delivery was a common independent risk factor for severe lacerations shared between primiparous and multiparous women.

*Conclusions:* With regard to severe perineal lacerations during vaginal delivery, there are multiple obstetric contributory factors despite routine episiotomy, among them, nulliparity, longer labor duration, greater newborn head circumference, and instrument-assisted vaginal delivery. The latter should only be performed after careful evaluation.



## Introduction

A third- or fourth-degree laceration is a serious adverse outcome of vaginal delivery. Symptoms associated with severe perineal injuries include flatus and stool incontinence, urinary and sexual dysfunction, perineal pain, and recto-vaginal fistula [1,2]. The prevalence of severe perineal lacerations following vaginal delivery varies amongst different ethnicities, locations of childbirth, and age when performed [3–7]. A global survey from 24 countries on maternal and perinatal health reported that the prevalence of third- and fourth-degree lacerations ranged from 0.1% to 15% [7]. Among various obstetric parameters, primiparity, instrument-assisted vaginal delivery and heavy newborn birth weight were previously identified to be significantly associated with severe perineal lacerations [8–12]. Other risk factors include advanced maternal age, postterm pregnancies, induction of labor, prolonged second stage of labor, epidural anesthesia, Asian ethnicity, and episiotomy [3,4,13–15].

Episiotomy itself poses a risk of severe perineal lacerations following vaginal delivery according to previous reports [14,15]; however, in our country, routine episiotomy is still being performed during vaginal deliveries because many obstetricians still believe this technique may facilitate the delivery process. The purposes of this study were to investigate the risk factors of third- and fourth-degree lacerations following vaginal delivery in Taiwanese women and to offer clinical guidance to reduce the rate of severe perineal lacerations.

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## Materials and methods

This observational cohort study included 1879 consecutive parturients who received vaginal deliveries assisted by midline episiotomy at 36 weeks of gestation or more in our institution, a tertiary hospital, from November 2004 to August 2005. Demographic, medical, and obstetric data were documented and stored in a computerized database. Those with nonvertex fetal presentations, multiple gestations, cesarean deliveries, and those who were delivered before 36 gestational weeks were excluded from this study. The study has been approved by the ethics committee of our institution.

Under local anesthesia with lidocaine, the episiotomy performed in our institution consisted of an incision of approximately 3 cm over the midline of the perineum from the introitus to just above the anus, prior to fetal head crowning. Routine vaginal delivery management included active manual protection of the perineum and the fetal head when the latter was crowning through the vagina. Fundal pressure was banned during entire delivery. Women with prolonged second stage of labor underwent instrument-assisted deliveries. Prolonged second stage was defined as lasting more than 2 h or 3 h depending on parity and if epidural anesthesia was used, as proposed by the American College of Obstetricians and Gynecologists [16]. All perineal or vaginal injury repairs and instrument deliveries were performed by experienced obstetricians. The perineal status was examined by the delivery doctor and recorded into the delivery log at the time of delivery. These data were then entered into a computerized database. A third-degree laceration was defined as an injury to the perineum involving the anal sphincter muscles, whereas a fourth-degree laceration referred to an injury to the perineum extending to the rectal mucosa [17]. Both types of lacerations were considered as severe perineal lacerations.

The computerized database was analyzed to compare various obstetric parameters between women with and without third- and fourth-degree lacerations. These parameters included maternal age, parity, education level, previous miscarriages, maternal height, maternal weight (prepregnancy and at delivery), body mass index (prepregnancy and at delivery), labor courses (first and second stages of labor), the use of intrapartum epidural anesthesia, instrument-assisted vaginal delivery, and the newborn's birth weight and head circumference. Continuous data were analyzed using the Student $t$ test, and the relative proportions were compared using the Chi-square test. The variables that were found to be statistically significant in by univariate analysis were retested using the multivariate logistic regression model to identify the independent risk factors. Data were analyzed using the SPSS version 20.0 for Windows (SPSS, Inc., Chicago, IL, USA). Probability values less than 0.05 were considered statistically significant.

## Results

Of the 1879 parturients, 1039 (55.3%) were primiparae and 840 (44.7%) were multiparae. The mean maternal age was 29.9 years (range 23–38) and the mean parity was 1.6 (range 1–6). Epidural analgesia was administered to 601 (32.0%) of the women. The number of instrument-assisted deliveries was 151 (8.0%), all of which were carried out by vacuum extraction. A total of 205 women (10.9%) acquired a third- or fourth-degree laceration, including 16.4% in nulliparous ($n = 170$) and 4.2% in multiparous ($n = 35$). Comparisons of demographic and obstetric characteristics between patients with severe and nonsevere perineal lacerations are shown in Table 1. The number of nulliparous women, the duration of first and second stages of labor, the frequency of instrument-assisted vaginal deliveries, newborn's birth weight and head circumference, and the ratio of the newborn's birth weight to maternal body mass index were significantly different between the two groups. In Table 2, logistic regression demonstrates that nulliparity (odds ratio = 3.626, 95% confidence interval: 2.393–5.497, $p < 0.001$), the duration of second stage of labor (odds ratio = 1.002, 95% confidence interval: 1.000–1.104, $p = 0.049$), instrument-assisted vaginal delivery (odds ratio = 4.102, 95% confidence interval: 2.749–6.120, $p < 0.001$), and newborn's head circumference (odds ratio = 1.323, 95% confidence interval: 1.172–1.492, $p < 0.001$) were independent risk factors of severe perineal lacerations.

Tables 3 and 4 illustrate the discrimination of risk factors for severe perineal laceration between primiparous and multiparous women. As revealed in Table 3, the duration of second stage of labor, the frequency of instrument-assisted vaginal delivery and epidural analgesia, newborn's birth weight and head circumference, and the ratio of the newborn's birth weight to maternal body mass index were significantly different between severe and nonsevere perineal lacerations in primiparous women. Table 4 shows that multiparous women have a longer duration of first and second stages of labor, and higher frequency of instrument-assisted vaginal

**Table 1**
Comparison of various obstetric characteristics between severe and nonsevere perineal laceration groups.

| Variable | Laceration ($n = 205$) | No laceration ($n = 1674$) | Total ($N = 1879$) | $p$ |
|---|---|---|---|---|
| Maternal age (y) | 29.7 ± 4.3 | 29.9 ± 4.3 | 29.9 ± 4.2 | 0.529 |
| Parity | 1.5 ± 0.4 | 1.6 ± 0.7 | 1.6 ± 0.7 | 0.176 |
| Previous miscarriages | 27.3% | 25.3% | 25.5% | 0.540 |
| Completed college | 67.8% | 64.3% | 64.7% | 0.474 |
| Maternal height (cm) | 159.3 ± 5.2 | 159.7 ± 5.0 | 159.6 ± 5.0 | 0.140 |
| Prepregnancy BW (kg) | 55.6 ± 29.1 | 54.1 ± 8.9 | 54.2 ± 12.7 | 0.876 |
| BW at delivery (kg) | 67.9 ± 9.1 | 68.1 ± 16.5 | 68.1 ± 15.9 | 0.242 |
| Prepregnancy BMI (kg/m$^2$) | 21.0 ± 3.3 | 21.2 ± 3.3 | 21.2 ± 3.3 | 0.964 |
| BMI at delivery (kg/m$^2$) | 26.9 ± 3.2 | 26.6 ± 3.4 | 26.6 ± 3.6 | 0.080 |
| Nulliparity | 170 (82.9%) | 869 (51.9%) | 1039 (55.3%) | <0.001 |
| First stage (min) | 381.9 ± 463.2 | 270.0 ± 283.4 | 282.1 ± 304.8 | <0.001 |
| Second stage (min) | 79.3 ± 81.4 | 43.5 ± 62.7 | 47.4 ± 65.9 | <0.001 |
| Instrument delivery | 56 (27.3%) | 95 (5.7%) | 151 (8.0%) | <0.001 |
| Epidural analgesia | 73 (35.6%) | 528 (31.5%) | 601 (32.0%) | 0.238 |
| Newborn birth weight (g) | 3290.3 ± 380.1 | 3168.2 ± 740.3 | 3181.4 ± 710.4 | <0.001 |
| HC of newborn (cm) | 33.8 ± 1.3 | 33.3 ± 1.4 | 33.4 ± 1.5 | <0.001 |
| Newborn birth weight/Prepregnancy BMI | 163.2 ± 73.7 | 152.4 ± 48.2 | 153.6 ± 51.5 | <0.001 |

Data are presented as mean ± standard deviation or $n$ (%).
BMI = body mass index; BW = body weight; HC = head circumference.

**Table 2**
Logistic regression analyses of risk factors for severe perineal laceration following vaginal delivery.

| Variable | OR | 95% CI | *p* |
|---|---|---|---|
| Nulliparity | 3.626 | 2.393–5.497 | <0.001 |
| First stage | 1.000 | 1.000–1.001 | 0.343 |
| Second stage | 1.102 | 1.000–1.104 | 0.044 |
| Instrument delivery | 4.102 | 2.749–6.120 | <0.001 |
| Newborn birth weight | 1.000 | 1.000–1.001 | 0.631 |
| Newborn HC | 1.323 | 1.172–1.492 | <0.001 |
| Newborn birth weight/prepregnancy BMI | 1.003 | 0.999–1.007 | 0.101 |

BMI = body mass index; CI = confidence interval; HC = head circumference; OR = odds ratio.

delivery. In logistic regression analyses on all variables, instrument-assisted vaginal delivery came out as a common independent risk factor of severe lacerations among both nulliparous and multiparous population (Table 5).

## Discussion

Previous studies have reported the prevalence of third- and fourth-degree lacerations to be 0.1–10.2% in developed countries [18–21] and 0.1–15% in developing countries [7]. In our study, the prevalence of third- and fourth-degree perineal lacerations was 10.9%, which is higher than most of the previously reported data [3–7,18–21]. There are three plausible explanations for the higher frequency of severe lacerations. First, unlike previous reported data including preterm deliveries, our series only comprised women with no less than 36 weeks of gestation, which might increase the

**Table 5**
Logistic regression analyses of risk factors for severe perineal laceration in nulliparous and multiparous women.

| | OR | 95% CI | *p* |
|---|---|---|---|
| Nulliparous | | | |
| Second stage | 1.778 | 1.174–2.691 | 0.007 |
| Instrument delivery | 3.570 | 2.309–5.520 | <0.001 |
| Epidural analgesia | 1.019 | 0.986–1.016 | 0.304 |
| Newborn birth weight | 1.007 | 0.984–1.011 | 0.525 |
| HC of newborn | 1.188 | 1.017–1.387 | 0.029 |
| Newborn birth weight/prepregnancy BMI | 1.027 | 0.999–1.018 | 0.771 |
| Multiparous | | | |
| First stage | 1.123 | 0.934–1.206 | 0.434 |
| Second stage | 1.174 | 0.247–5.579 | 0.840 |
| Instrument delivery | 8.905 | 3.036–26.116 | <0.001 |

BMI = body mass index; CI = confidence interval; HC = head circumference; OR = odds ratio.

**Table 3**
Comparison of various obstetric characteristics between severe and nonsevere perineal laceration groups in nulliparous women.

| Variable | Laceration ($n$ = 170) | No laceration ($n$ = 869) | Total ($N$ = 1039) | *p* |
|---|---|---|---|---|
| Maternal age (y) | 28.4 ± 3.9 | 29.1 ± 3.9 | 29.0 ± 3.9 | 0.063 |
| Previous miscarriages | 27.6% | 24.2% | 24.7% | 0.313 |
| Completed college | 70.1% | 69.4% | 69.5% | 0.731 |
| Maternal height (cm) | 159.6 ± 5.3 | 159.8 ± 5.0 | 159.8 ± 5.1 | 0.293 |
| Prepregnancy BW (kg) | 55.8 ± 31.7 | 53.2 ± 8.8 | 53.6 ± 15.1 | 0.233 |
| BW at delivery (kg) | 68.0 ± 9.1 | 67.7 ± 9.7 | 67.8 ± 9.6 | 0.106 |
| Prepregnancy BMI (kg/m$^2$) | 20.9 ± 3.2 | 20.8 ± 3.2 | 20.8 ± 3.2 | 0.181 |
| BMI at delivery (kg/m$^2$) | 26.8 ± 3.2 | 26.5 ± 3.4 | 26.6 ± 3.4 | 0.053 |
| First stage (min) | 402.9 ± 468.5 | 348.5 ± 306.2 | 357.4 ± 338.5 | 0.141 |
| Second stage (min) | 87.2 ± 81.1 | 66.0 ± 75.1 | 69.4 ± 76.5 | 0.003 |
| Instrument delivery | 49 (28.8%) | 81 (9.3%) | 130 (12.5%) | <0.001 |
| Epidural analgesia | 66 (38.8%) | 421 (48.3%) | 487 (46.8%) | 0.014 |
| Newborn birth weight (g) | 3276.4 ± 364.6 | 3104.6 ± 348.9 | 3132.8 ± 357.1 | <0.001 |
| HC of newborn (cm) | 33.8 ± 1.3 | 33.2 ± 1.5 | 33.3 ± 1.5 | <0.001 |
| Newborn birth weight/prepregnancy BMI | 164.5 ± 80.0 | 151.8 ± 23.7 | 153.9 ± 39.2 | 0.001 |

Data are presented as mean ± standard deviation or $n$ (%).
BMI = body mass index; BW = body weight; HC = head circumference.

**Table 4**
Comparison of various obstetric characteristics between severe and nonsevere perineal laceration groups in multiparous women.

| Variable | Laceration ($n$ = 35) | No laceration ($n$ = 805) | Total ($N$ = 840) | *p* |
|---|---|---|---|---|
| [fx2]Maternal age (y) | 30.5 ± 4.3 | 31.1 ± 4.4 | 31.0 ± 4.3 | 0.114 |
| Previous miscarriages | 25.7% | 26.6% | 26.5% | 0.679 |
| Completed college | 57.1% | 58.9% | 58.8% | 0.545 |
| Maternal height (cm) | 158.0 ± 4.4 | 159.5 ± 4.9 | 159.5 ± 4.9 | 0.074 |
| Prepregnancy BW (kg) | 54.6 ± 9.9 | 54.9 ± 8.8 | 55.0 ± 8.9 | 0.580 |
| BW at delivery (kg) | 67.5 ± 9.0 | 68.6 ± 21.7 | 68.5 ± 21.3 | 0.731 |
| Prepregnancy BMI (kg/m$^2$) | 21.9 ± 4.0 | 21.6 ± 3.3 | 21.6 ± 3.3 | 0.984 |
| BMI at delivery (kg/m$^2$) | 27.0 ± 3.4 | 26.6 ± 3.3 | 26.6 ± 3.4 | 0.648 |
| First stage (min) | 280.1 ± 197.9 | 185.3 ± 225.9 | 189.2 ± 225.5 | <0.001 |
| Second stage (min) | 40.9 ± 69.8 | 19.2 ± 33.1 | 20.1 ± 35.6 | 0.023 |
| Instrument delivery | 7 (20%) | 14 (1.7%) | 21 (2.1%) | <0.001 |
| Epidural analgesia | 7 (20%) | 107 (13.3%) | 114 (13.6%) | 0.186 |
| Newborn birth weight (g) | 3354.2 ± 448.1 | 3238.2 ± 1001.4 | 3243.1 ± 984.6 | 0.094 |
| HC of newborn (cm) | 34.1 ± 1.6 | 33.6 ± 1.4 | 33.6 ± 1.4 | 0.054 |
| Newborn birth weight/prepregnancy BMI | 156.9 ± 28.9 | 153.2 ± 65.1 | 153.3 ± 64.0 | 0.268 |

Data are presented as mean ± standard deviation or $n$ (%).
BMI = body mass index; BW = body weight; HC = head circumference.

severe laceration rate. Second, previous studies suggested that under-diagnosis of third- and fourth-degree lacerations in developing countries may be common [7,22]. Third, episiotomy was routinely performed to assist vaginal deliveries in our series, which was known to be a risk factor of severe perineal laceration [14,15].

Although there is no consensus in regard to the contributing factors of severe perineal lacerations, most studies have consistently reported that instrument-assisted vaginal delivery [3,8–12,20,21], nulliparity [3,8–11,19,23] and heavy newborn birth weight [3,8–12,19,20] were risk factors for third- and fourth-degree lacerations. Our data showed that severe perineal lacerations correlated with four parameters: nulliparity, duration of second stage of labor, vacuum-assisted vaginal delivery, and newborn's head circumference. Multiparity was associated with a 3.6 times risk reduction of severe perineal lacerations, compared with nulliparity. Our results were compatible with previous studies, which reported a 3.0–7.3 times higher risk of third- and fourth-degree lacerations among nulliparous women, compared with multiparous women [9–11,19,23]. The possible mechanism accounting for the risk difference is the lack of elasticity of the perineum among nulliparous women [9,10,19]. According to univariate analyses, for primiparous women, there were several contributing factors of severe perineal laceration, including labor course duration, instrument-assisted vaginal deliveries, epidural analgesia, newborn's birth weight and head circumference, and the ratio of the newborn's birth weight to maternal body mass index; whereas in multiparous women a longer labor course and instrument-assisted delivery played a role. To illustrate the discrimination of risk factors for severe perineal laceration between primiparous and multiparous women, logistic regression analysis was further applied to disclose that duration of second stage of labor, newborn's head circumference and vacuum-assisted vaginal delivery contributed to severe laceration in primiparae, but only vacuum-assisted vaginal delivery was a significant contributing factor for multiparae.

Several studies have suggested that prolonged duration of the second stage of labor is associated with an increased risk of severe perineal and vaginal lacerations in primiparous women [3,24–26]. Cheng et al [26] observed that multiparous women with a second stage longer than 3 hours had higher risks of operative vaginal deliveries and maternal morbidities, including severe perineal lacerations. Kudish et al [9] reported that the use of instrument-assisted vaginal delivery, particularly in combination with midline episiotomy, was related to a significant increase in the risk of anal sphincter trauma in both primigravid and multigravid women. Regardless of parity, women in our series who received vacuum-assisted vaginal deliveries had 4.1 times the rate of severe perineal lacerations compared with those who underwent spontaneous vaginal deliveries. Our result is concordant with previous studies, which also suggested that vacuum-assisted delivery is considered a risk factor for severe perineal lacerations (OR 2.6–9.5) [3,9,12,21].

Fetal head circumference is another factor that was found to be connected with severe perineal lacerations in this study. Aytan et al [27] reported that the newborn's head circumference was significantly greater in women with severe perineal lacerations when compared with those without severe lacerations. In fact, routine prenatal ultrasound performed a few days before delivery is a useful tool to help with detection of those large head circumference newborns. Melamed et al [28] compared sonographic estimations of fetal head circumference obtained within 3 days before delivery with actual measurements performed immediately after delivery; they found that there is a high correlation between sonographic and postnatal measurements of head circumference ($r = 0.845$, $p < 0.001$). Several previous reports have also demonstrated that lower newborn birth weights resulted in smaller risk of severe perineal lacerations [9,11,19,23]. Macrosomia was associated with 2–3 times higher risk of third- and fourth-degree lacerations versus that with normal birth weights [13]. In the univariate analysis of primiparae, heavy newborn birth weight was shown to be a significant risk factor of severe perineal lacerations, but it failed to prove to be an independent factor in multivariate logistic regression.

Several reports have demonstrated that Chinese and other Asian women have higher incidences of severe perineal laceration compared with other ethnic groups. This may be because of the fact that Asian women have a relatively shorter perineum, hence a lesser degree of stretch and a higher risk of fetal–maternal disproportion [13,18,20,28]. Schwartz et al [29] observed that the ratio of the newborn's birth weight to maternal body mass index is a stronger predictor of laceration rate than either the birth weight or the maternal body mass index alone. However, although univariate analysis in primiparae has shown this ratio to be a significant risk factor for severe perineal lacerations, the ratio was not identified as an independent risk factor after adjusting for confounders.

In Taiwan, episiotomy at term delivery has been reported as a routine intervention in almost all primiparous and multiparous women [30]. Regarding the potential role of episiotomy, previous studies have demonstrated that patients who received routine episiotomy were associated with a higher incidence of severe perineal lacerations than those who received selective episiotomy [1,9,15,31–33]. Although selective episiotomy may increase the rate of anterior perineal lacerations, the traumas are less severe and have fewer complications than posterior perineal lacerations caused by midline episiotomy [34,35]. Thus, selective episiotomy is related to less frequency of posterior perineal lacerations, perineal pain, and wound dehiscence [31,32]. Based on the lower incidence of severe perineal lacerations following selective episiotomies reported in previous studies compared with patients who received routine episiotomies in our series, we encourage the establishment of new obstetric protocols in Taiwan to avoid routine episiotomy during unnecessary conditions that may increase the rate of severe perineal lacerations.

The limitation of the present study relates to its retrospective and cross-sectional design, thus the results may not completely represent the general population. In addition, we have no data in the computerized database to analyze the experience and skill of the operator, which may be a confounding factor for the severity of perineal laceration. The strength of this analysis is attributed to the accurate diagnosis of third- and fourth-degree lacerations made by experienced obstetricians.

In conclusion, in spite of routine episiotomy that reportedly can contribute to perineal lacerations, the coexistence of other obstetric factors may complicate the obstetric outcomes. These factors include nulliparity, prolonged duration of labor, and large fetal head circumference, which all play important roles in the development of severe perineal lacerations. Finally, instrument-assisted vaginal deliveries should be selectively performed with caution whenever possible.

## Conflicts of interest

The authors have no conflicts of interest relevant to this article.

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